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Kashiwada et al.

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(54) **DEVICE CONNECTOR HAVING OUTER CONDUCTOR WITH A MOLD PORTION SANDWICHED BETWEEN A BRACKET AND A HOUSING**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**

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H01R 13/512	(2006.01)
H01R 13/73	(2006.01)
H01R 13/52	(2006.01)
H01R 13/58	(2006.01)

(52) **U.S. Cl.**

CPC ***H01R 13/512*** (2013.01); ***H01R 13/73*** (2013.01); *H01R 13/5202* (2013.01); *H01R 13/5845* (2013.01)

(58) **Field of Classification Search**

CPC ... H01R 13/73; H01R 33/975; H01R 33/7664
USPC 439/345, 352–358
See application file for complete search history.

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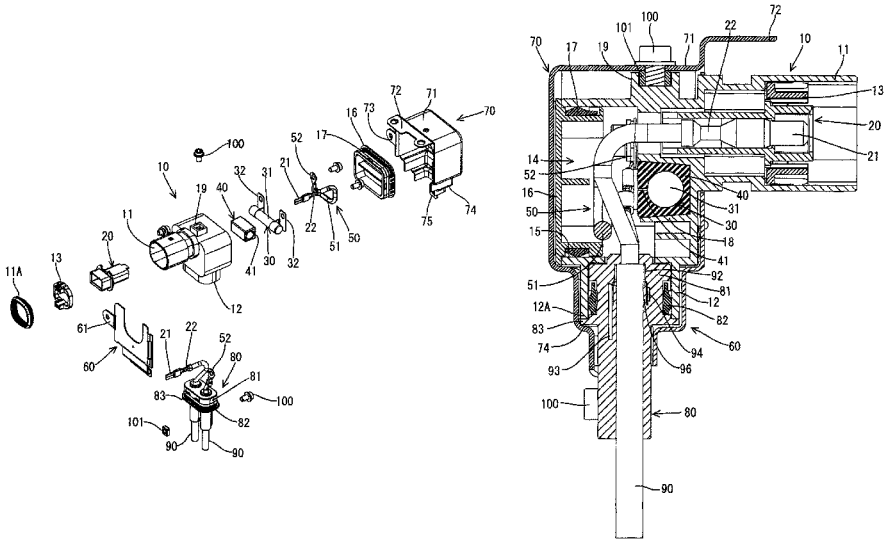
(57) **ABSTRACT**

A device connector is to be connected to a device and includes male terminals (**21**) to be connected to female terminals in the device, Shield cables (**90**) are pulled out in a direction different from a connecting direction to the female terminals. An inner conductor (**50**) electrically conductively connects the male terminals (**21**) and the shield cables (**90**). A mold portion (**80**) is formed by molding the shield cables (**90**) with resin. A rear bracket (**70**) immovably fixes the housing (**10**) to a case of the device. A housing (**10**) has the inner conductor (**50**) accommodated inside, and a seal ring (**82**) seals between the mold portion (**80**) and the housing (**10**). The mold portion (**80**) is sandwiched between the rear bracket (**70**) and the housing (**10**) in a pull-out direction of the shield cables (**90**).

7 Claims, 13 Drawing Sheets



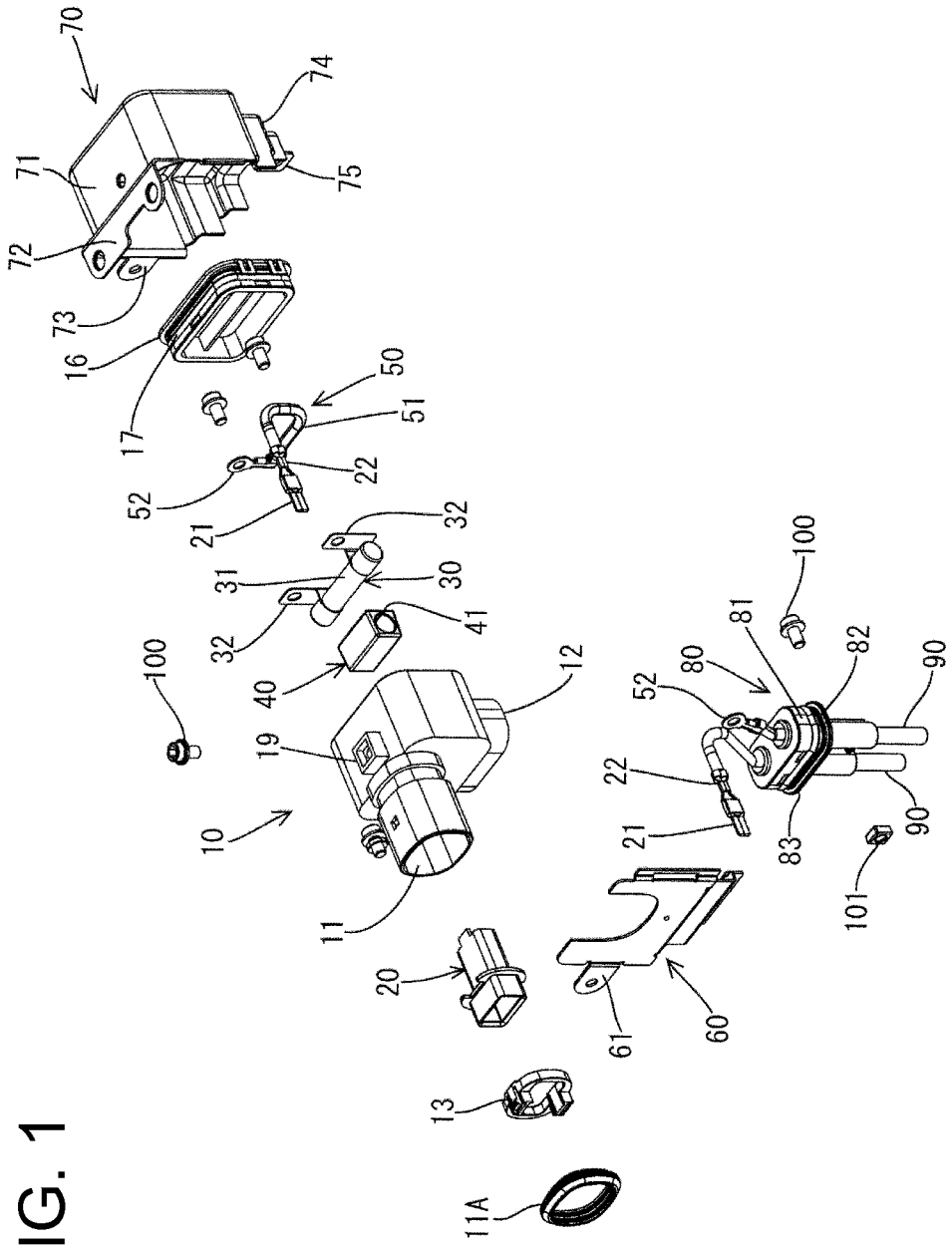

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FIG. 1

FIG. 2

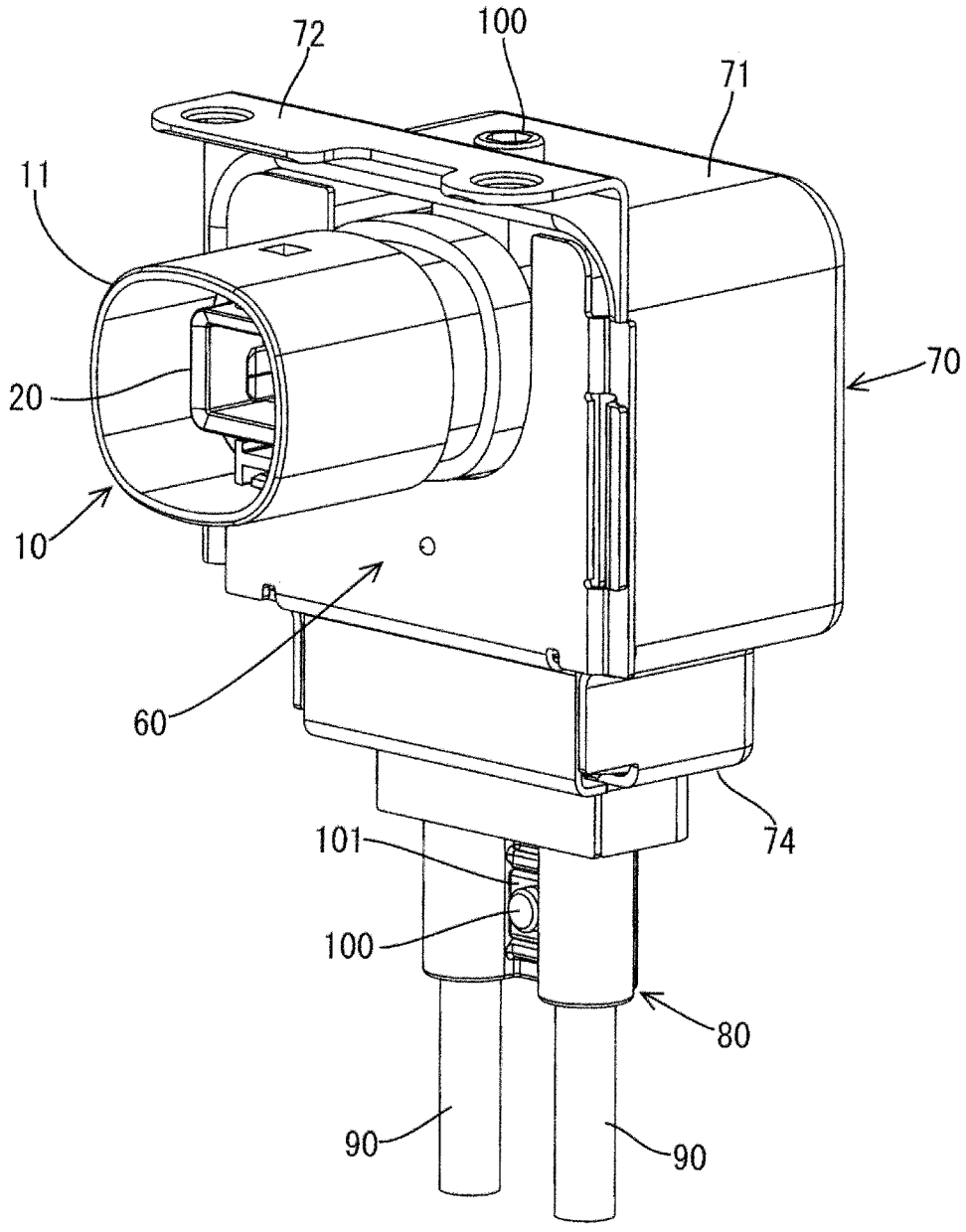

FIG. 3

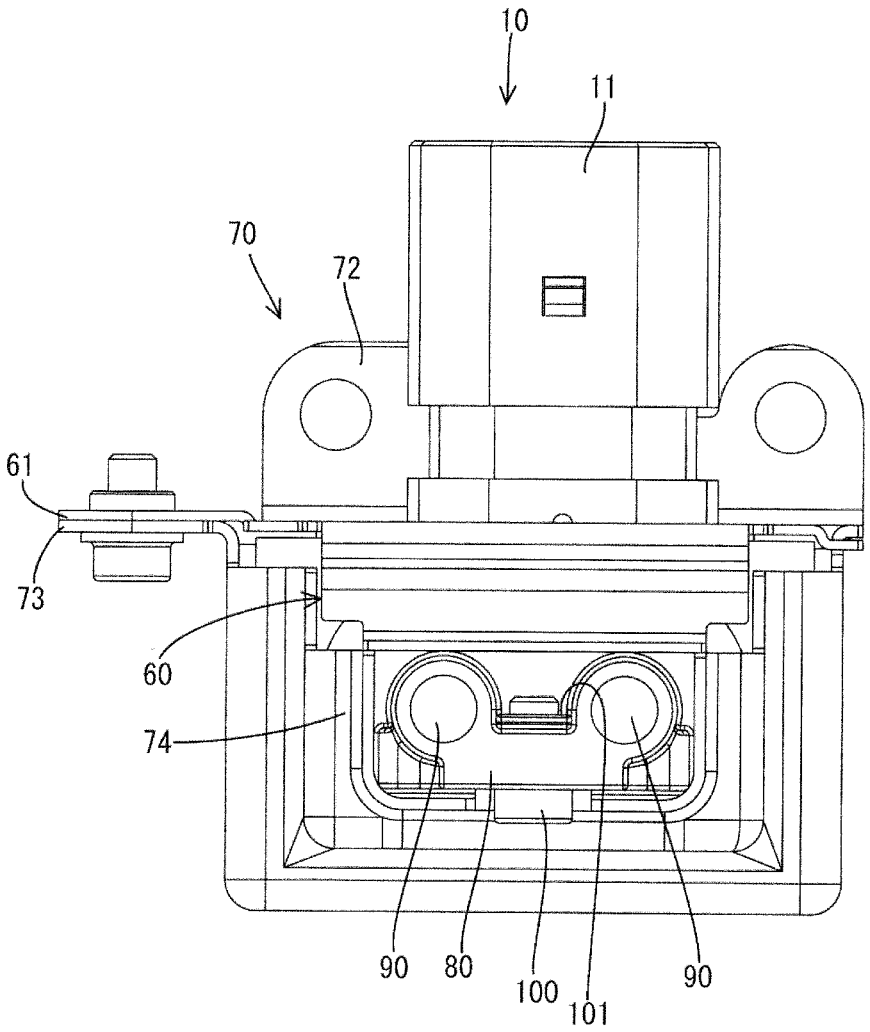

FIG. 4

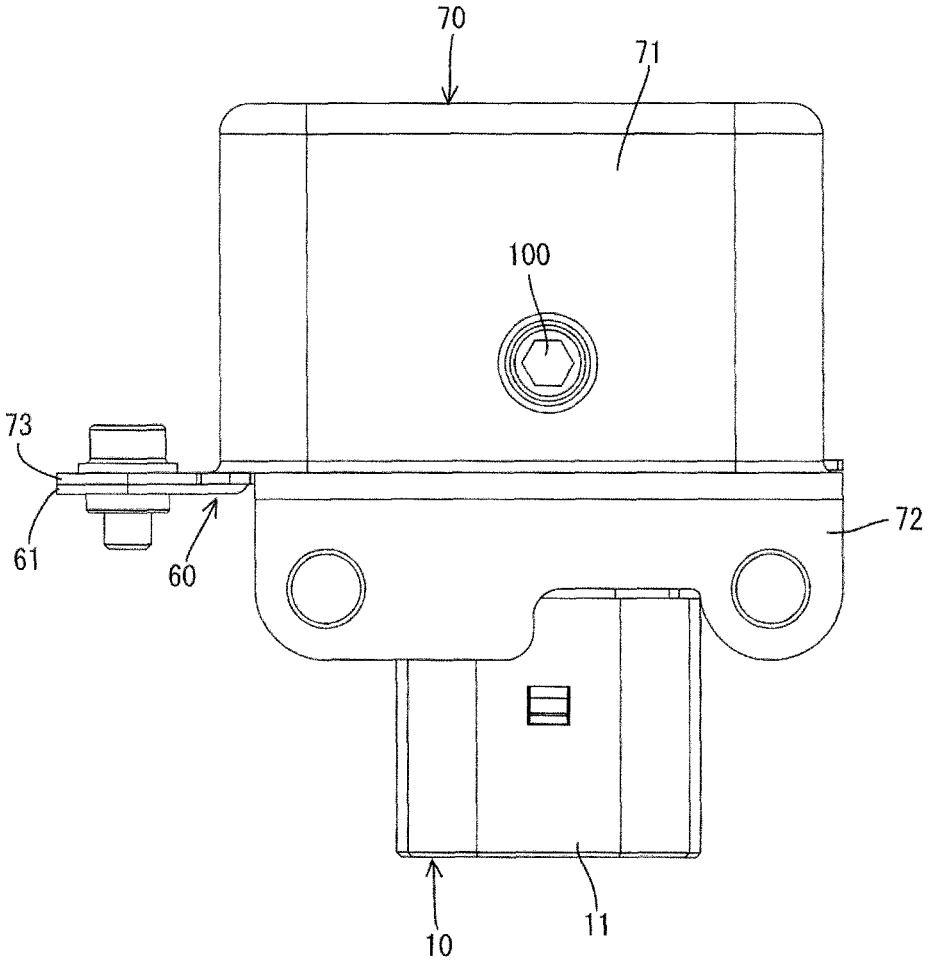

FIG. 5

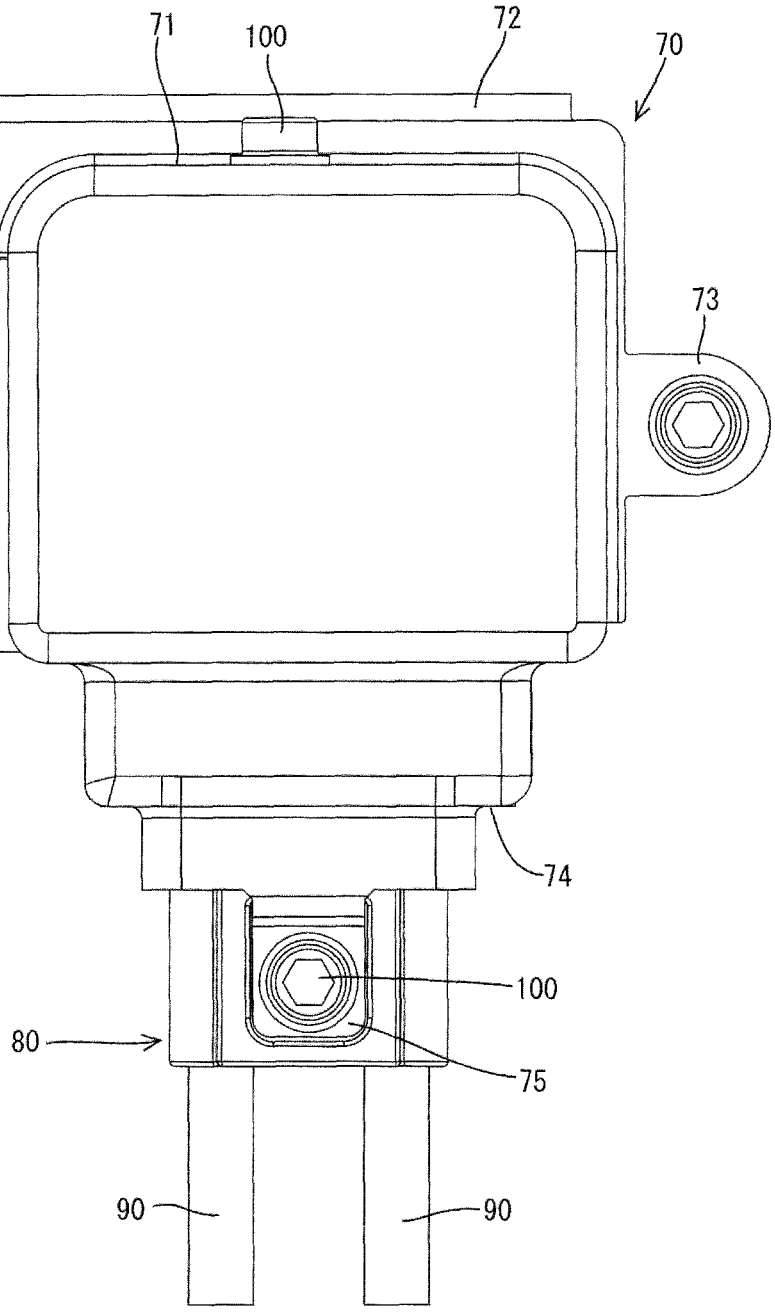

FIG. 6

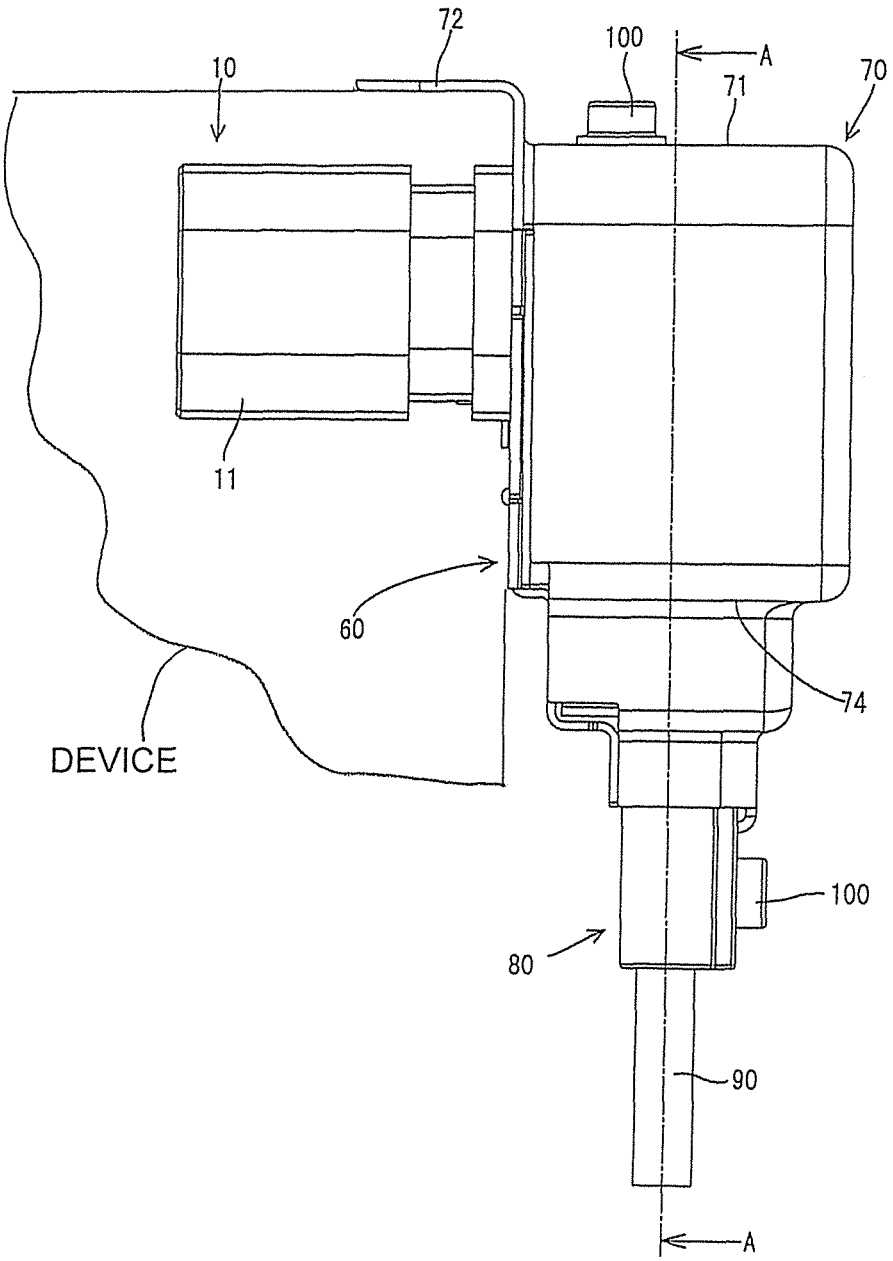

FIG. 7

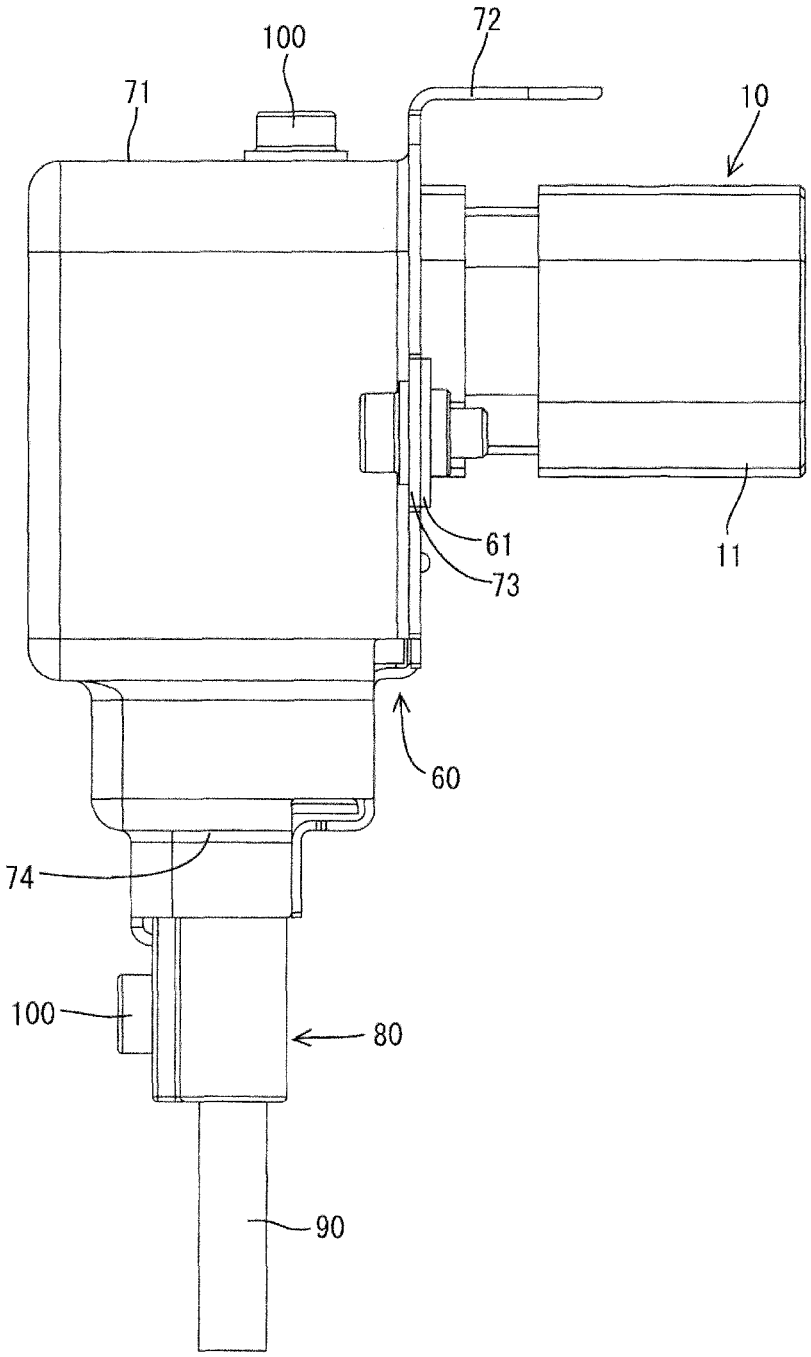

FIG. 8

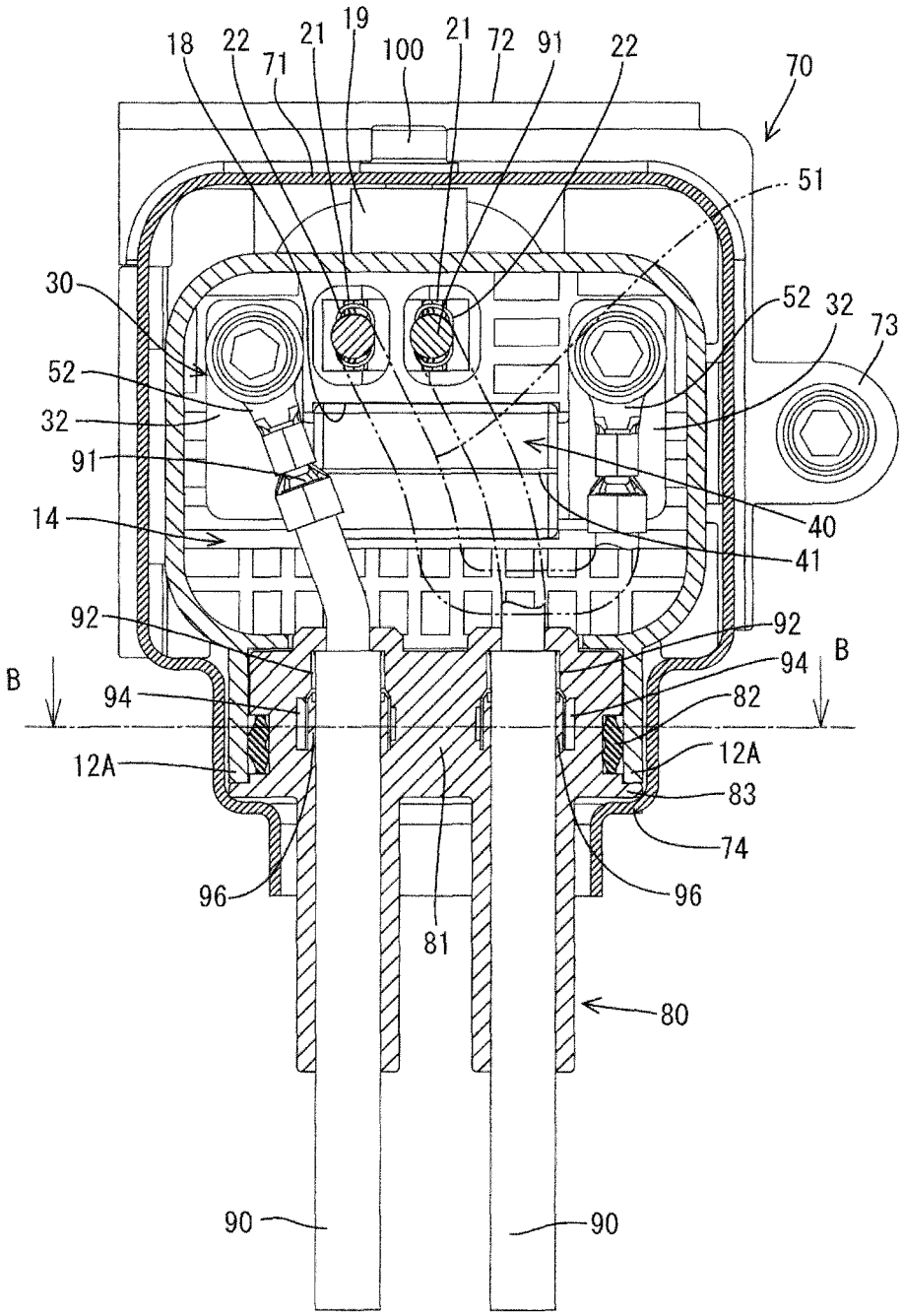
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FIG. 9

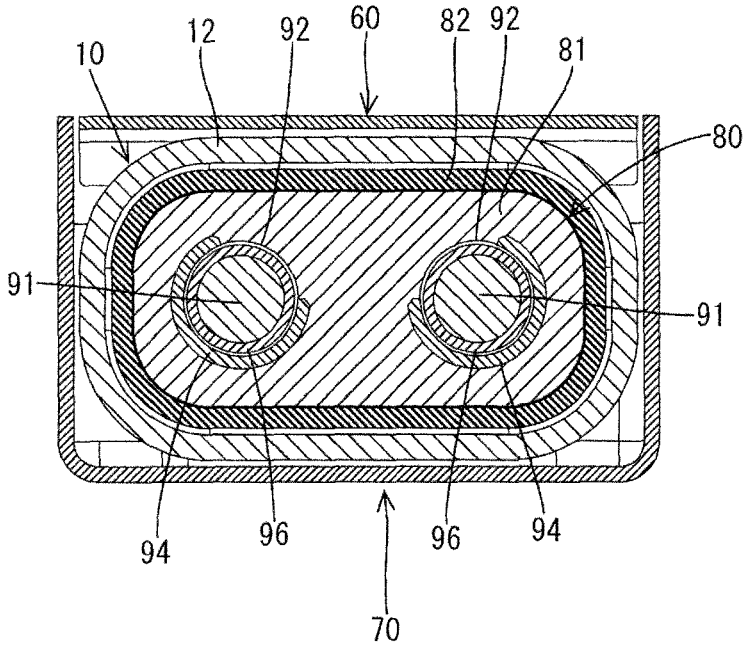

FIG. 10

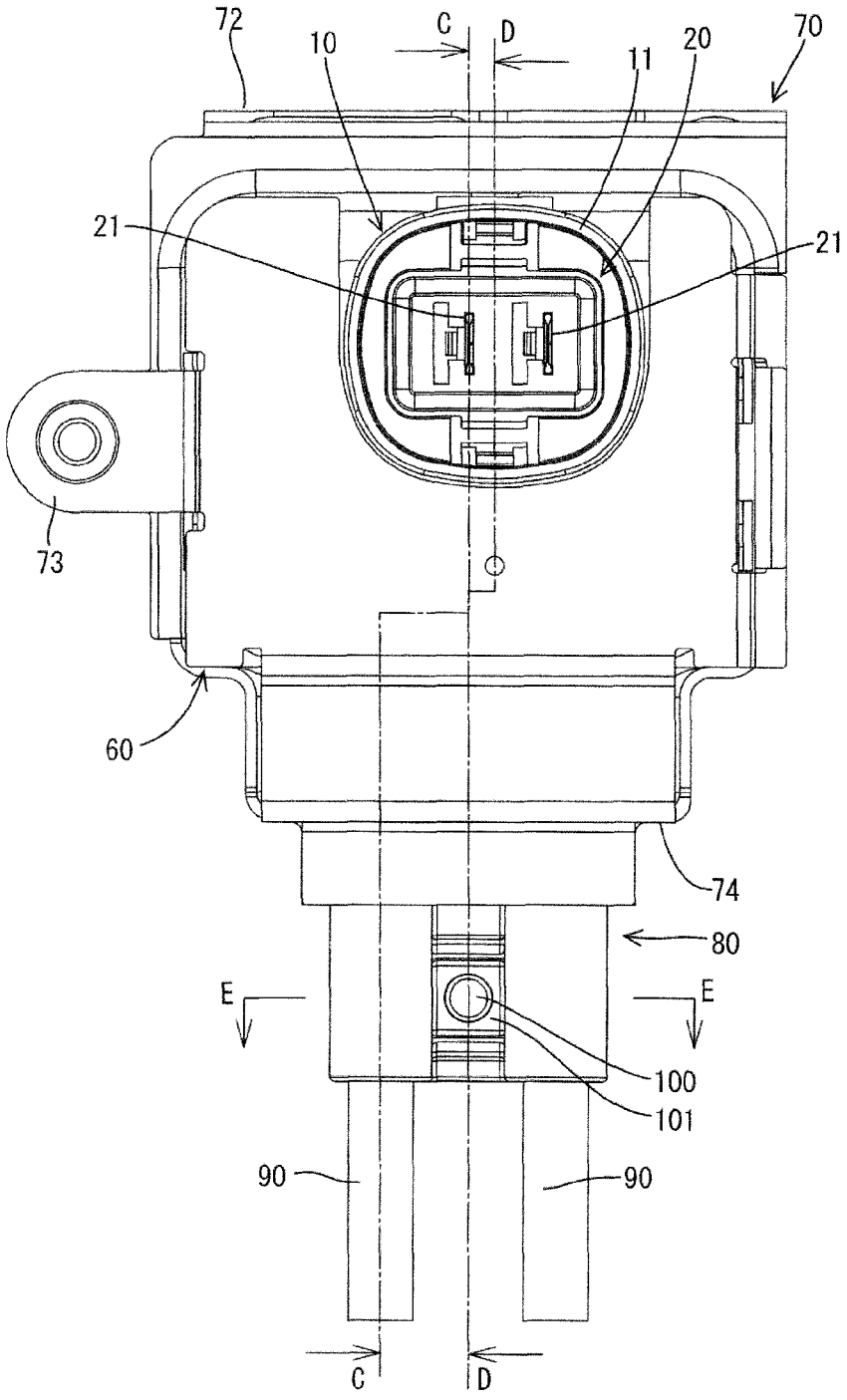

FIG. 11

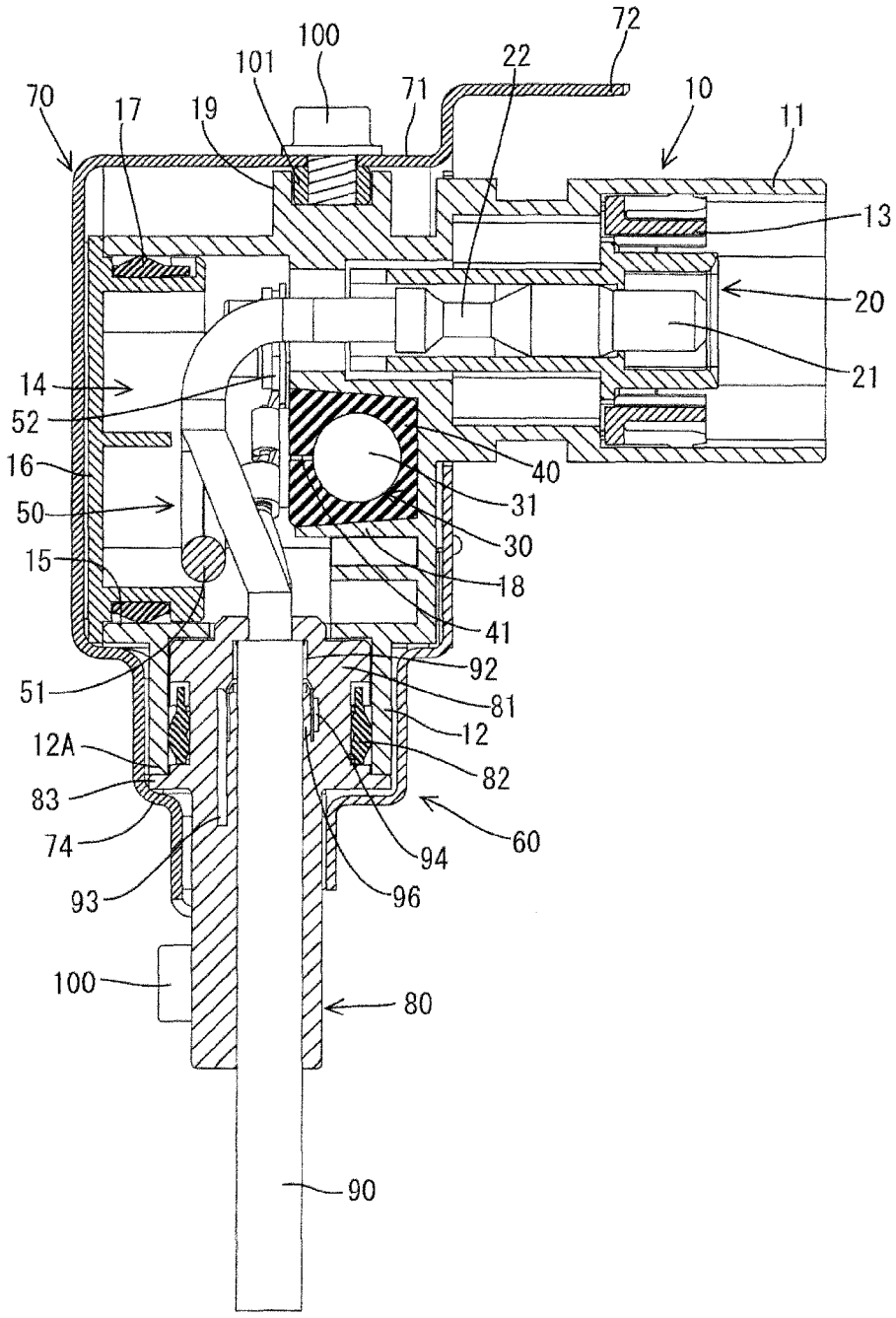
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FIG. 12

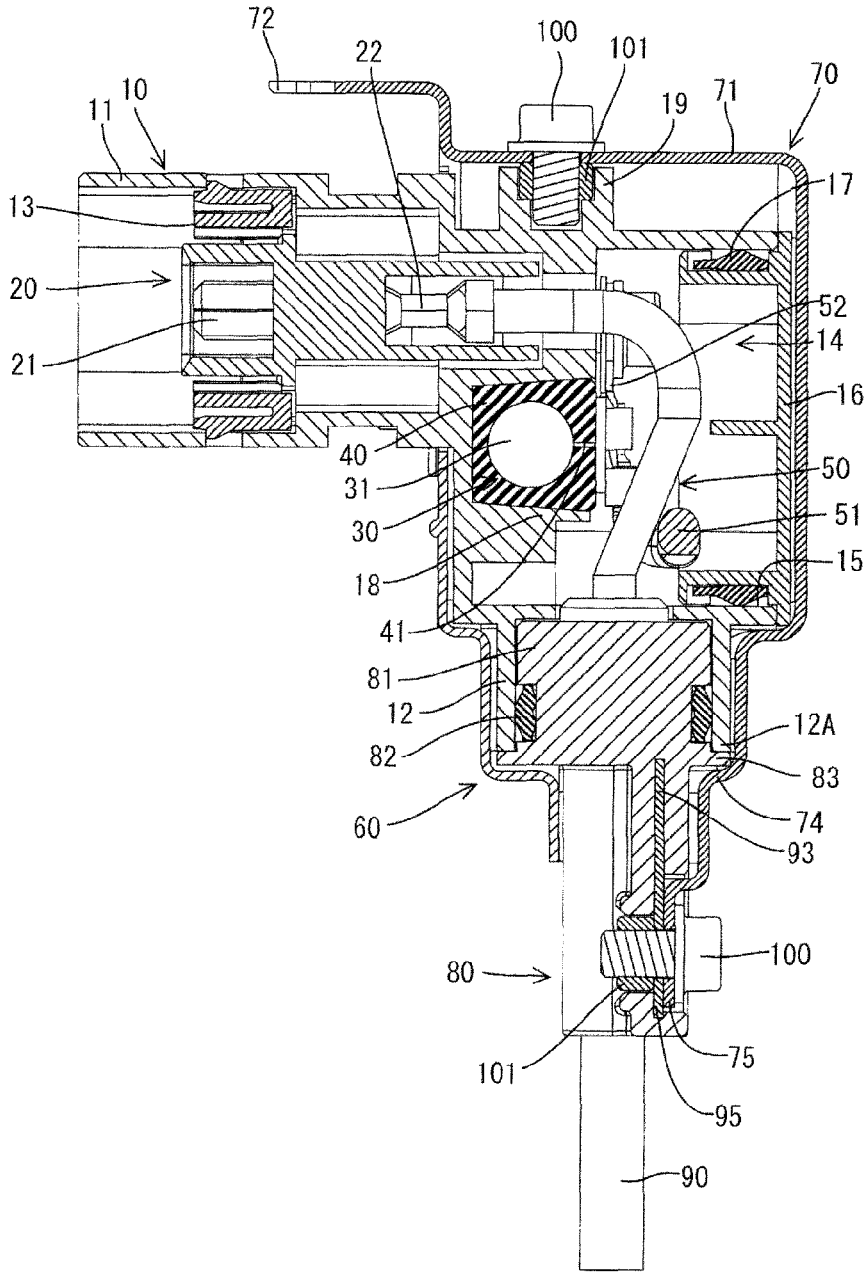
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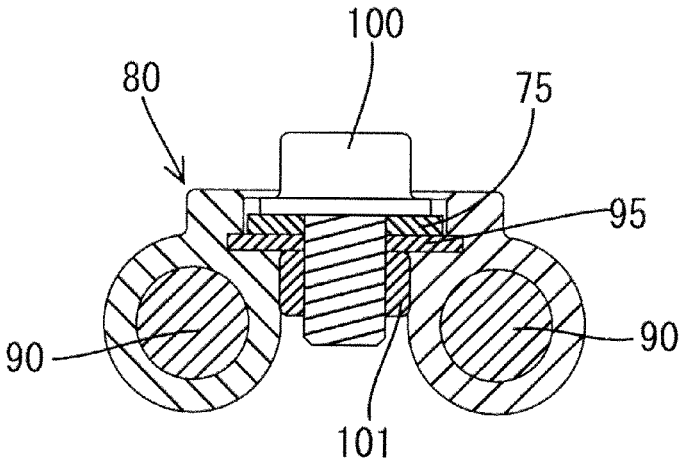
FIG. 13



DEVICE CONNECTOR HAVING OUTER CONDUCTOR WITH A MOLD PORTION SANDWICHED BETWEEN A BRACKET AND A HOUSING

BACKGROUND

1. Field of the Invention

The invention relates to a device connector.

2. Description of the Related Art

Japanese Unexamined Patent Publication No. 2003-317821 discloses a device connector to be mounted on a case of a device. The device connector includes a device connecting portion to be connected to a device-side terminal provided in a device. An outer conductor is pulled out in a direction different from a connecting direction to the device-side terminal. An inner conductor electrically connects the device connecting portion and the outer conductor. A housing accommodates the inner conductor inside and rubber plug is mounted on a part of the housing where the outer conductor is pulled out and is retained by a retainer.

The retainer is not fixed firmly to the housing. Thus, vibration cannot be blocked reliably when the outer conductor vibrates, and contact portions of the device-side terminal and the device connecting portion may slide on each other.

The invention was completed in view of the above situation and aims to protect contact portions of a device-side terminal and a device connecting portion by reducing vibration of an outer conductor.

SUMMARY OF THE INVENTION

The invention relates to a device connector to be connected to a device. The device connector includes a device connecting portion to be connected to a device-side conductor provided in the device. An outer conductor is pulled out in a direction different from a connecting direction to the device-side conductor and an inner conductor electrically conductively connects the device connecting portion and the outer conductor. The inner conductor is accommodated in a housing; a mold portion formed by molding the outer conductor with resin; and a bracket immovably fixes the housing to a case of the device. At least part of the mold portion is sandwiched between the bracket and the housing in a pull-out direction of the outer conductor. Thus, the mold portion reliably protects the contacts of the device-side terminal from vibration when the shield cable vibrates in the pull-out direction thereof.

The device connector may further comprise a seal for sealing between the mold portion and the housing. The seal prevents water from entering the housing.

The mold portion may be immovably fixed to the bracket. Thus, the vibration of the outer conductor is blocked reliably in directions other than the pull-out direction of the outer conductor.

The outer conductor preferably is a shield cable in which a shield layer is arranged around a core. The shield layer may be a braided wire.

The mold portion may be formed by integrally molding the shield cable and a shield plate connected to the shield layer.

The mold portion preferably is fixed immovably to the bracket by connecting the shield plate to the bracket. The bracket preferably is electrically conductive. According to such a configuration, the shield plate and the case of the device can be electrically conductively connected via the bracket. Thus, shield performance can be improved.

Two shield cables may be juxtaposed in the mold portion, and the mold portion may be fixed to the bracket in a dead space between the shield cables.

These and other features of the invention will become more apparent upon reading of the following detailed description of preferred embodiments and accompanying drawings. It should be understood that even though embodiments are described separately, single features may be combined to additional embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view of a device connector.

FIG. **2** is a front perspective view of the device connector.

FIG. **3** is a bottom view of the device connector.

FIG. **4** is a plan view of the device connector.

FIG. **5** is a rear view of the device connector.

FIG. **6** is a right side view of the device connector.

FIG. **7** is a left side view of the device connector.

FIG. **8** is a section along A-A of FIG. **6**.

FIG. **9** is a section along B-B of FIG. **8**.

FIG. **10** is a front view of the device connector.

FIG. **11** is a section along C-C of FIG. **10**.

FIG. **12** is a section along D-D of FIG. **10**.

FIG. **13** is a section along E-E of FIG. **10**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A device connector in accordance with the invention includes a housing **10** made e.g. of synthetic resin, a terminal accommodating portion **20**, a fuse **30**, a heat radiating rubber portion **40**, an inner conductor **50**, an electrically conductive front bracket **60**, a rear bracket **70**, a mold **80**, one or more shield cables **90**, etc. The device connector is fittable into a mounting hole of a case of a device **100**, as shown in FIG. **6**.

The housing **10** includes a fitting **11** that can fit into the mounting hole of the device and a mounting portion **12** on which the mold portion **80** is to be mounted. A fitting direction of the fitting portion **11** into the mounting hole and a mounting direction of the mold portion **80** to the mounting portion **12** are substantially perpendicular. As shown in FIG. **11**, the fitting **11** has a forwardly open receptacle and the mounting portion **12** has a downwardly open receptacle. The terminal accommodating portion **20** is accommodated into the fitting **11** from the front, and a holder **13** prevents detachment of the terminal accommodating portion **20**. A resilient or rubber ring **11**A is mounted on the outer peripheral surface of the fitting.

An accommodation space **14** is formed between the fitting **11** and the mounting portion **12** of the housing **10** and accommodates the inner conductor **50**, the fuse **30**, etc. inside. The accommodation space **14** communicates with the inner spaces of both the fitting portion **11** and the mounting portion **12**. A service hole **15** is open on a rear wall forming the accommodation space **14** and is closed by a service cover **16**. The service cover **16** includes a tubular portion to be fit into the service hole **15**, and a rubber ring **17** is mounted on the outer peripheral surface of the tubular portion to prevent water from entering through the service hole **15** and into the accommodation space **14**.

A fuse mounting portion **18** is formed in the accommodation space **14** in which the fuse **30** and the heat radiating rubber portion **40** are to be at least partly mounted. This fuse mounting portion **18** is open rearward and has an inclined inner surface formed to increase a vertical dimension toward

the back. The fuse **30** particularly includes a substantially cylindrical fuse main body **31** and two fuse electrodes **32** formed respectively on opposite ends of the fuse main body **31**. The fuse main body **31** has a known structure as a fuse and generates heat due to the flow of electricity.

The heat radiating rubber portion **40** is molded from a resilient material e.g. rubber and is mounted in the fuse mounting portion **18** while fit closely around the fuse main body **31**. Further, the heat radiating rubber portion **40** closely contacts both the fuse main body **31** and the fuse mounting portion **18**. Thus, the heat radiating rubber portion **40** fills out an air layer that would otherwise be formed between the fuse main body **31** and the fuse mounting portion **18**. As a result, the heat radiating rubber portion **40** forms a heat-bridge between the fuse **30** and the housing **10** and has a higher thermal conductivity than air so that heat generated in the fuse main body **31** is transferred efficiently to the fuse mounting portion **18** via the heat radiating rubber portion **40**. The heat transferred to the fuse mounting portion **18** is transferred to the rear bracket **70** from the outer surface of the housing **10** and further to the case of the device.

The heat radiating rubber portion **40** has a slit **41** formed by cutting the heat radiating rubber portion **40** radially out from the inner surface of an accommodation hole that accommodates the fuse main body **31**. The slit **41** can be widened resiliently so that the heat radiating rubber portion **40** can be fit around the fuse main body **31** so that the fuse main body **31** is covered by the heat radiating rubber portion **40**. Thus, the heat radiating rubber portion **40** is mounted easily on the fuse main body **31** merely by opening the slit **41**.

As shown in FIG. **11**, male terminals **21** are accommodated in the terminal accommodating portion **20**. The male terminals **21** can be connected to female terminals (not shown) provided in the device. Specifically, the male terminals **21** are tabs arranged laterally side by side and in a vertical orientation as shown in FIG. **10**. One of the male terminals **21** is connected directly to one shield cable **90**, as shown in FIG. **8**, but the other male terminal **21** is connected to the other shield cable **90** via the inner conductor **50**, the fuse electrodes, **32** and the fuse **30**. The inner conductor **50** includes an inner wire **51** connected to an end of the male terminal **21** and two substantially round terminals **52** respectively connected to the fuse **30** and the fuse electrodes **32**. In other words, the fuse **30** is arranged at an intermediate position of a conductive path of the inner conductor **50**.

The shield cable **90** is configured such that a braided wire **92** or other shield layer is arranged around a core **91** and insulating resin is arranged between the core **91** and the braided wire **92**. Two shield cables **90** are arranged substantially adjacent to each other, and the respective braided wires **92** are connected together to a shield plate **93**. Specifically, as shown in FIG. **9**, an underlay ring **96** is to be mounted on the outer periphery of the shield cable **90**, the braided wire **92** is arranged on the outer periphery of this underlay ring **96** and the braided wire **92** is caulked or sandwiched between a barrel piece **94** of the shield plate **93** and the underlay ring **96**.

The mold portion **80** is formed by molding the shield cables **90** and shield plate **93** with resin. The mold portion **80** has a shaft **81** that can be fit in the mounting portion **12** and a seal ring **82** is mounted on the outer periphery of a shaft **81**. Thus, the seal ring **82** is sandwiched between the outer peripheral surface of the shaft **81** and the inner peripheral surface of the mounting portion **12** to prevent fluid from entering the housing **10** through the mounting portion **12**. The barrel pieces **94** of the shield plate **93** are molded in the shaft **81**. Further, as shown in FIG. **12**, a bracket connecting portion **95** of the shield plate **93** is exposed below or from the shaft **81** and is at least partly between the shield cables **90**.

As shown in FIG. **11**, the rear bracket **70** is made of an electrically conductive metal plate and is mounted along the outer surface of the housing **10** to at least partly cover the housing **10** in a range from the rear surface to the upper surface. At least one boss **19** projects up on the upper surface of the housing **10** and a nut **101** is press-fit into the boss **19**, and the rear bracket **70** is fixed to the housing **10** by tightening a bolt **100** while sandwiching a ceiling wall **71** of the rear bracket **70** between the bolt **100** and the nut **101**. An attaching portion **72** projects forward from the front edge of the ceiling wall **71** of the rear bracket **70** and is to be bolt-fastened to the case of the device.

The front bracket **60** includes a cut for the escape of the fitting **11**, and is mounted substantially along the outer surface of the housing **10** to cover the front surface of the housing **10** excluding the fitting **11**. As shown in FIGS. **3** and **4**, the front bracket **60** and the rear bracket **70** each include a protrusion **61**, **73** that protrudes laterally, and both brackets **60**, **70** are connected to each other by bolt-fastening the protrusions **61**, **73**.

As shown in FIG. **11**, an outer rib **83** is provided around the outer periphery of the mold portion **80** and contacts an opening edge **12**A of the mounting portion **12** from below. Further, a part of the rear bracket **70** adjacent and below the mounting portion **12** is formed into a step **74** that contacts the outer rib **83** from below. The outer rib **83** is sandwiched vertically in a pull-out direction of the shield cables **90** between the opening edge **12**A of the mounting portion **12** and the step **74**. Thus, the mold portion **80** is fixed so as not to move vertically relative to the housing **10**. Thus, any vibration transferred from the shield cables **90** in the pull-out direction of the shield cable **90** is blocked by the mold portion **80**.

A fastening seat **75** is formed on a lower part of the rear bracket **70**, as shown in FIG. **12**, and is bolt-fastened to the bracket connecting portion **95**. Further, a nut **101** is press-fit at a position of the mold portion **80** corresponding to the bracket connecting portion **95**. The fastening seat **75** and the bracket connecting portion **95** are fastened while being sandwiched between a bolt **100** and the nut **101** to fix the mold portion **80** to the rear bracket **70**. In this way, the mold portion **80** is fixed so as not to move relative to the housing **10**, including in directions other than the pull-out direction of the shield cables **90**. Simultaneously, the braided wires **92** are shield-connected to the case of the device via the shield plate **93** and the rear bracket **70** to improve shield performance.

The underlay ring **96** is mounted on the shield cables **90** in advance. The braided wires **92** then are exposed by applying peeling to ends of the shield cables **90** and are folded back to fit on the outer periphery of the underlay ring **96**. The barrel pieces **94** of the shield plate **93** then are caulked and fixed to the braided wires **92**. The shield cables **90** connected to the shield plate **93** then are set in a forming mold and molded with resin to form the mold portion **80**. The seal ring **82** is mounted on the shaft **81** of the mold portion **80** and the shaft **81** is fitted into the mounting portion **12** of the housing **10**.

On the other hand, the terminal accommodating portion **20** is mounted into the fitting **11** of the housing **10** from the front and the holder **13** is mounted therein from the front to fix the terminal accommodating portion **20** in the fitting **11**. The slit **41** of the heat radiating rubber portion **40** is opened and the heat radiating rubber portion **40** is fit on the fuse main body **31** of the fuse **30**. The resulting assembly then is pushed into the fuse mounting portion **18**. In this way, the heat radiating rubber portion **40** is disposed to fill the air layer between the

fuse main body **31** and the fuse mounting portion **18** and closely contacts both the fuse main body **31** and the fuse mounting portion **18**.

Subsequently, as shown in FIG. **8**, the core **91** of the right shield cable **90** is crimped, bent or folded to the barrel **22** of the male terminal **21**, and the male terminal **21** is inserted into the terminal accommodating portion **20** from behind. On the other hand, the round terminal **52** is crimped to the core **91** of the left shield cable **90** and bolt-fastened to the left fuse electrode **32**. Further, the male terminal **21** and the round terminal **52** are crimped respectively to opposite ends of the inner wire **51**, the round terminal **52** is bolt-fastened to the right fuse electrode **32**, and the male terminal **21** is inserted into the terminal accommodating portion **20** from behind. Thereafter, the service cover **16** is mounted at the service hole **15** to seal the accommodation space **14** of the housing **10**.

The front bracket **60** is mounted on the front surface of the housing **10**, the rear bracket **70** is mounted on the upper and rear surfaces of the housing **10**, and the protrusions **61**, **73** of the respective brackets **60**, **70** are bolt-fastened. In this way, the brackets **60**, **70** are formed into an integral bracket and mounted on the outer surfaces of the housing **10** excluding the fitting **11**. Thus, heat generated in the fuse **30** is transferred to the case of the device via the heat radiating rubber portion **40**, the housing **10** and the respective brackets **60**, **70** and does not stay in the housing **10**.

The rear bracket **70** is fixed to the housing **10** by tightening the bolt **100** into the nut **101** press-fit into the boss **19** of the housing **10**, and the fastening seat **75** and the bracket connecting portion **95** are fixed conductively by tightening the bolt **10** into the nut **101**. The fitting **11** of the housing **10** then is inserted into the mounting hole in the case of the device. The attaching portion **72** of the rear bracket **70** then is bolt-fastened to the case of the device so that the rear bracket **70** and the case are fixed electrically conductively. Thus, vibration transferred from the shield cables **90** is blocked by the mold portion **80** and does not affect contact portions of the male terminals **21** and the female terminals.

As described above, the mold portion **80** is sandwiched between the step **74** of the rear bracket **70** and the opening edge **12**A of the mounting portion **12** of the housing **10**. Thus, the mold portion **80** can be fixed immovably in the pull-out direction of the shield cables **90**. Thus, when the shield cables **90** vibrate in the pull-out direction, that vibration can be blocked reliably or reduced significantly by the mold portion **80** and the contacts of the female terminals and the male terminals **21** can be protected. Further, the seal ring **82** prevents fluid or water from entering into the housing **10**.

The mold portion **80** may be fixed immovably to the rear bracket **70**. Accordingly, since the mold portion **80** can be fixed to the housing **10** via the rear bracket **70**, vibration of the shield cables **90** also can be blocked or reduced in directions other than the pull-out direction of the shield cables **90**.

Each shield cable **90** is configured so that the braided wire **92** is arranged around the core **91**, and the mold portion **80** is formed by integrally molding the shield cables **90** and the shield plate **93** connected to the braided wires **92**. The mold portion **80** may be immovably fixed to the rear bracket **70** by connecting this shield plate **93** to the electrically conductive rear bracket **70**. Thus, the shield plate **93** and the case of the device can be connected electrically conductively via the rear bracket **70**. Thus, shield performance can be improved.

The shield cables **90** may be juxtaposed in the mold portion **80** and the mold portion may be fixed to the rear bracket **70** between the pair of shield cables **90**. According to such a configuration, the shield cables **90** can be fixed together to the rear bracket **70** via the shield plate **93**. Further, the mold portion **80** can be fixed to the rear bracket **70** utilizing a dead space formed between the shield cables **90**.

The invention is not limited to the above described embodiment. For example, the following embodiments also are included in the scope of the invention.

The outer rib **83** of the mold portion **80** is sandwiched between the step **74** of the rear bracket **70** and the opening edge **12**A of the mounting portion **12** in the above embodiment. However, the shaft **81** of the mold portion **80** may be sandwiched between the back wall of the mounting portion **12** and the step **74**.

The fastening seat **75** of the rear bracket **70** and the bracket connecting portion **95** of the shield plate **93** are bolt-fastened in the above embodiment. However, the mold portion **80** may be fixed immovably to the rear bracket **70** e.g. by press-fitting the shaft **81** of the mold portion **80** into the mounting portion **12**.

An individual core shielding structure is adopted by individually shielding the shield cables **90** in the above embodiment. However, a collective shielding structure may be adopted by collectively shielding two wires according to the invention.

What is claimed is:

1. A device connector to be connected to a device, comprising:

a housing to be connected to the device in a connecting direction;

a bracket for immovably fixing the housing to the device;

a device connecting portion mounted in the housing and extending in the connecting direction;

at least one outer conductor pulled out of the housing in a direction different from the connecting direction;

an inner conductor electrically conductively connecting the device connecting portion and the at least one outer conductor, the inner conductor being accommodated at least partly in the housing; and

a mold portion formed by molding the at least one outer conductor with resin, the mold portion being sandwiched at least partly between the bracket and the housing in a pull-out direction of the at least one outer conductor.

2. The device connector of claim **1**, further comprising a seal for sealing between the mold portion and the housing.

3. The device connector of claim **1**, wherein the mold portion is fixed immovably to the bracket.

4. The device connector of claim **1**, wherein the at least one outer conductor is at least one shield cable in which a shield layer is arranged around a core.

5. The device connector of claim **4**, wherein the mold portion is formed by integrally molding the at least one shield cable and a shield plate connected to the shield layer.

6. The device connector of claim **5**, wherein the mold portion is immovably fixed to the bracket by connecting the shield plate to the bracket.

7. The device connector of claim **6**, wherein the at least one shield cable comprises two shield cables substantially juxtaposed in the mold portion, and the mold portion is fixed to the bracket substantially between the two shield cables.

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